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The Integration of Technical Subjects in Civil Technology Curriculum with Special Reference to Further Education and Training(FET) Technical Schools

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ABSTRACT This study aimed at investigating the extent to which Civil Technology Teachers understand and implement Curriculum. The research used qualitative and quantitative methodology to collect data, questionnaires and interviews were used as instruments to collect data. The sample of the study consisted of 21 Civil Technology teachers from 18 Technical schools from 5 education districts in the Free State. Teachers revealed that majority of respondents indicated that Department of Education (DoE) failed to offer formal training on the new Civil Technology Curriculum, but received one week workshops. They regarded Civil Technology as a subject developed for high level of knowledge and skills. Teachers recommended that the Department of Education should provide a full training course on the new understanding and implementation of Civil Technology Curriculum in Free State Schools in South Africa.

INTRODUCTION

Twenty years is a long time in the relatively short global history of Technology Education. It is an even longer time in the educational history of a democratic South Africa. According to Steven (2006: 1-2) prior 1994 education in South Africa was organised on racial lines with separate schools, universities, teachers colleges and administration systems for each of the four main groups as defined by the previous apartheid South African state: namely black, white, coloured and Indian. Note that it is offensive to use these racial labels; it is difficult to describe or understand South African education system without almost continual reference to them. To complicate matters further, there were four so-called 'independent homelands' within the borders of the country for four of the main black population groups, each having their own educational ministry and administration. Although the curricula in each of these systems was theoretically equal, the huge differential in state fund-

ing made a mockery of the apartheid state's claim of 'separate but equal' treatment for all race. In terms of resources the subjects such as science, home economics, woodwork and the other 'practical' subjects (which many see as the forerunners of technology education) very little provisioning was made in the black schools. This was particularly true in the rural schools where large proportions of black children were (and still are) educated. The result was that few schools in South Africa offered subjects with a 'practical' orientation: those that did were largely to be found in urban areas and were, to a large extent, reserved for white children only.

The South African education system changed rapidly since 1998, when curriculum 2005 (C2005), founded on the outcomes-based (OBE) to teaching was phased in. This curriculum was then revised in 2002 (RNCS) and the national curriculum statement was introduced in 2006 (Teis 2010: 1; National Department of Education 2003) and curriculum and assessment policy statement (CAPS) in 2011 (DBE 2011: 3) and things also changed; the name of the subjects, and even reducing number of subject by combining them to form a subject civil technology as a part of the subjects in the Manufacturing, Engineering and Technology (MET) field, which has been produced out of the NATED 550 subjects known as (civil technika, plumb-

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ing, building and plastering, woodwork and woodworking), with regard to knowledge, skills, values development (DBE 2011: 3). This subject has the major role to play in society and community at large NDE (2005).

The traditional subject teachers are concerned about the way this subject has been structured in the national curriculum statement (Karlin 2010). The subject is more in theory orientated than practical orientated and it gives less emphasis in practical than theory. This has resulted in negative attitude towards the policy and the subject in particular (Beute and Karlin 2010). The formation and interpretation of the curriculum in South African schools need more attention, because Civil technology has its own terminology or communication all over the world (Van der Walt 2010: 212) and the traditional teacher need to enhance Civil Technology pedagogic content knowledge to enhance effectiveness and implementation of the curriculum.

Background

The background provide different curriculums used in South Africa through educational system of curriculum change.

National Curriculum Statement (NCS)

Civil Technology aims at developing a high level of knowledge and skills in learners. It sets high expectations of what all South African learners can achieve. Social justice requires the empowerment of those sections of the population previously disempowered by a lack of knowledge and skills. Civil Technology specifies the minimum standards of knowledge and skills to be achieved at each grade and sets high, achievable standards in all fields. The emphasis on use and application of new technology ensures that high knowledge and high skill are not compromised in this subject (DoE 2008: 9).

Curriculum Assessment Policy Statement (CAPS)

Civil Technology focuses on concepts and principles in the built environment and on the technological process. It embraces practical skills and the application of scientific principles. This subject aims to create and improve the built environment to enhance the quality of life of the individual and society and to ensure the sus-

tainable use of the natural environment (DoE 2012: 8-9).

The aim of the subject Civil Technology is to develop the skills levels of learners from Grade 10-12 to such an extent that they will be able to enter a career pathway at a Further Education and Training College or a university immediately after obtaining the National Senior Certificate. Learners will be ready to enter into learnerships or apprenticeships that will prepare them for a trade test (DoE 2012: 8-9).

Curriculum Assessment Policy Statement on Specialisation “Draft”

Civil Technology focuses on concepts and principles in the built environment and on the technological process. It embraces practical skills and the application of scientific principles. This subject aims to create and improve the built environment to enhance the quality of life of the individual and society and to ensure the sustainable use of the natural environment. The subject focuses on three main areas, namely:

Civil Services

Civil services can be construed as plumbing which focuses on the supply of cold and hot water supplies to a building and the installation of a sewerage system enabling soiled, waste water and storm water removal from a site. It focuses on materials and the way it is used to provide water and sanitation on a site taking into account environmentally friendly technology (green energy). See the content overview for the subject specific to gain insight of the topics taught.

Construction

Construction focuses on the development of concrete and brick structures in the built environment. It focuses on materials and the way it is used to provide infrastructures in the development of sites taking into account environmentally friendly technology (green energy). See the content overview for the subject specific to gain insight of the topics taught.

Woodworking

Woodworking works hand in hand with construction. It focuses on structures such as roof

trusses, windows, doors and any part of a building that is made of timber. It also focuses on providing temporary supporting structures to obtain permanent structures such as concrete floors, stairs, roofs and arches. See the content overview for the subject specific to gain insight of the topics taught DoE (2013: 9).

Aim

The aim of the study is to explore the full course training of all specialized technical educators in order to enhance their knowledge and acquirement of new skills of civil technology with the view of building their confidence and positive attitude.

Objectives

The objectives of the study will be:

- Describe the meaning and integration of the subjects in civil technology curriculum.
- Examine the role of the educators and the learners in the curriculum integrated
- Develop recommendations on the implementation of civil technology curriculum.

RESEARCH METHODOLOGY

Research Design

The research used mixed method approach comprising qualitative as well as quantitative methodology to collect data in this research. The method of investigation includes a literature review, empirical study by using qualitative and quantitative method in the form of questionnaires and purposive sampling interview.

Mix methods research is defined as procedure for collecting, analysing and mixing both quantitative and qualitative data at some stage of the research process within a single study to understand a research problem more completely (Creswell 2005). In a mixed methods study both numerical and text data are collected and analysed to address different aspects of the same general research problem and provide its more complete understanding (Ivankova et al. in Maree 2009: 263).

Participant's Sample

Burns (2000: 464) is of the opinion that the sample chosen must serve the real purpose and

objectives of the research, gaining understanding with regard to a particular phenomenon chose. The population in this research was twenty one teachers responsible for teaching civil technology in all grades from schools in five districts of Free State province: Fezile Dabi, Motho, Lejweleputswa, Thabo Mofutsanyana and Xhariep.

According Changing Minds (2002-2012) purposive sampling starts with a purpose in mind and the sample is thus selected to include people of interest and exclude those who do not suit the purpose. Makgatho (2003) in purposive sampling the researcher identifies respondents who have expertise and an interest in the field under study. Six teachers' were selected, the first three were teachers with experience of three or more years teaching civil technology and the second three were teachers who are none experience teachers with less than three years teaching civil technology.

Data Collection

Questionnaire

A quantitative research method was used to test the theories about reality, looks for cause and effect used to gather data to test the questions (Inankova et al. 2007: 255). Questionnaires were distributed to the civil technology teachers in the Free State. The group consisted of teachers with woodwork, plumbing, building and plastering training, and teaching experience but do not have any formal training in civil technology and facilitate the learning field in FET schools and teachers with formal tertiary training in the Civil Technology learning field. The questionnaire focused on the teachers' ability of competency and attitudes to a new integrated subject Civil Technology.

De Vos et al. (2004: 179) claim that the use of questionnaires enables the researcher to explore the variables better and to obtain an idea of the spectrum of possible responses. Selesho (2010: 6) the questionnaires allows respondents more time and it can be completed whenever it suits them.

Interviews

A researcher conducted qualitative research to understand the research phenomena from the

Civil Technology teachers of five districts in Free State. One-on-one interview was conducted with four experienced and three none experience participants for teachers development on integration technical subjects in secondary schools and to answer a set of predetermined question that does allow for probing and clarification of answers. Interview was recorded by using audio tape and note taking with the permission of the participants.

According Kvale (1996: 11) the use of the interview in research marks a move away from seeing human subjects as simply manipulable and data as somehow external to individuals, and towards regarding knowledge as generated between humans, often through conversations. Cohen et al. (2004: 267) interview enable participants- be they interviewers or interviewees to discuss their interpretations of the world in which they live, and to express how they regard situations from their own point of view.

Data Analysis

Descriptive and inferential analysis will be used to analyse data from questionnaire. Rijkun

(2009) cited (Burns 2000: 43) as stated that Descriptive and Inferential statistics used in analysing the data from the questionnaire as it allowed the researcher to use numerical techniques to summarize the data. To analyse qualitative data from interview, Coding will be used to analyse data: Coding has been defined by Kerlinger (1970) as the translation of question responses and respondent information to specific categories for the purpose of analysis. Many questions are precoded, that is, each response can be immediately and directly converted into a score in an objective way (Cohen et al. 2004: 284).

RESULTS AND ANALYSIS

This part reports on the results of data gathered from teachers, questionnaire n=21 and interviews n=7 (teacher A-D were experienced in teaching and teacher E-G were none experienced in teaching (Table 1).

Majority (n=13) of Civil Technology teachers strongly agree that civil technology develop high level of knowledge and skills. Looking at the large number of respondents this implied

Table 1: Purpose of integrating technical subjects in civil technology curriculum

S. No.	Statement	Strongly agree (1)	Agree (2)	Disagree (3)	Strongly disagree (4)	Total number of response	
		No. of response	No. of response	No. of response	No. of response	No.	%
1	Civil Technology develop high level of knowledge and skill	13	7	0	1	21	100
2	All technical subjects in building related environment are integrated in civil technology curriculum	11	10	0	0	21	100
3	Civil Technology curriculum provide industrial knowledge needs which create job opportunity to learners	6	12	3	0	21	100
4	Civil Technology curriculum promote self-employment	3	7	10	1	21	100
5	Civil Technology curriculum establish general background of civil engineering	13	8	0	0	21	100
6	Civil Technology use 11 problem solving (technological process) as a main strategy or method	8	2	0	21	100	
7	Integration of mathematics and science principle applications Shows the important of Civil Technology curriculum	15	6	0	0	21	100

that teachers regard civil technology as high level knowledge and middle skill. Majority (n=11) of teachers are strongly agreed that all technical subjects in building related environment are integrated in civil technology curriculum. They also in majority (n=12) agreed that Civil Technology curriculum provides industrial knowledge needs which create job opportunity to learners, but they feather disagreed in majority (n=10) that Civil Technology curriculum promote self-employment. This indicates that civil technology can give all theoretical knowledge and less practical skill that can promote self-employment. Majority (n=13) of teachers strongly agreed that Civil Technology curriculum establish general background of civil engineering, and also strongly agreed in majority (n=11) that Civil Technology use problem solving (technological process) as a main strategy or method. This implied that civil gives a clear general background of civil engineering in general. Statement 7 intended to find out how important is mathematics and science in civil technology, therefore majority (n=15) of teachers strongly agreed that Integration of mathematics and science principle applications shows the important of Civil Technology curriculum (Table 2). This indicates that scientific and mathematical principle applications are clearly applied in a specific context. Interviews with teachers supported that teachers understand purely what the difference between civil technology and technical subjects and what civil technology comprised with.

Statement 8 managed to find out that majority (n=12) of teachers want to have a formal training in civil technology. This implies that teachers feel that they don't have full understanding of what to teach and how. Statement 9 intended to obtain information about teachers self-development, therefore majority (n=13) strongly agreed that they regularly attend departmental workshop and training. Majority of teachers are both (n=10) strongly agreed and agreed that they use multimedia (TV and Video) to enhance my teaching. Majority (n=16) of teachers strongly agreed that Site visit with learners stimulate understanding of integrated Civil Technology curriculum. Statement 12 intended to find out how teachers value problem solving. Majority of the teacher both strongly agreed (n=10) and agreed (n=10) that they use problem solving as the main method in the curriculum. Finding of the interview from both none experienced and experienced teachers shows that teachers did not received any formal training on civil technology curriculum, but only workshops and skills training offered to them in the duration of five day. This implied that teachers do need a sufficient formal training in Civil Technology Curriculum.

Statement 13, 14 and 15 intended to obtain information about the attitude of teachers in civil technology curriculum (Table 3). High number of teachers (n=7) strongly agreed that Civil Technology is for intelligent peoples only. Looking at statement 14 majority (n=12) of teachers strongly disagreed that Mathematics and science

Table 2: Role of the teacher in civil technology integrated curriculum

S. No.	Statement	Strongly agree (1)	Agree (2)	Disagree (3)	Strongly disagree (4)	Total number of response	
		No. of response	No. of response	No. of response	No. of response	No.	%
8	I will like to have more formal training in civil technology Curriculum	12	4	5	0	21	100
9	I regularly attend departmental workshop and training	13	6	0	2	21	100
10	I use multimedia (TV and Video) to enhance my teaching	10	10	1	0	21	100
11	Site visit with learners stimulate understanding of integrated Civil Technology curriculum	16	5	0	0	21	100
12	Do you use problem solving as the main method in the curriculum	10	10	1	0	21	100

Table 3: Teachers attitudes towards integrated curriculum

S. No.	Statement	Strongly agree (1)	Agree (2)	Disagree (3)	Strongly disagree (4)	Total number of response	
		No. of response	No. of response	No. of response	No. of response	No.	%
13	Civil Technology is for intelligent peoples only	7	5	6	3	21	100
14	Mathematics and scientific principles make Civil Technology less interesting subject	3	1	5	12	21	100
15	I was forced by the changing of education system to teach Civil Technology	1	10	4	6	21	100
16	I lack confidence in teaching applied mechanics in Civil Technology curriculum	0	6	6	9	21	100
17	I recommend full training course in applied mechanics	13	4	4	0	21	100

tific principles make Civil Technology less interesting subject. Majority (n=10) of teachers agreed that they were forced by the changing of system to teach Civil Technology. This shows that teachers are willing and interested to teach civil technology. Statement 16, 17 intended to find out how confident teacher are to teach applied mechanics in civil technology. Large number (n=9) of teachers strongly disagreed that they lack confidence in teaching applied mechanics in Civil Technology curriculum. Looking at statement 17 majority (n=13) of teachers strongly agreed that they recommend full training course in applied mechanics. This shows that teacher has confidence to teach applied but they are making a strong recommendation of full training course in applied mechanics to bust their confidence. Also from the interview results teachers are very interested to learn more in applied mechanics specific to the subject as they enthuses that it enhance understanding of mathematics and science principles.

DISCUSSION

Purpose of Integrating Technical Subjects in Civil Technology Curriculum

The research revealed that teachers were clear on the integration of technical subjects to civil technology referring to statement asked from Table 1 statement number 1,2,3,4,6 and 7 where majority of the teachers agreed that civil

technology develop a high knowledge of and skills also provide industrial knowledge, but their disagree with the statement 4 that civil technology promote self-employment because of poor practical work it produce, “the question is which type of self-employment we are looking at?” from the interview perspective teachers mention self-employment as technical skill such as plumbing, carpentry and building. That also raised a question if findings in statement 4 shows that teachers in majority n=13 strongly agreed that Civil Technology curriculum establish general background of civil engineering, “what about other self-employment career such as consultant agency in civil technology or engineering?” Civil Technology was introduced at high school level to give learners a clear background of Civil Engineering and its various career opportunities that learners can opt for the career of their choice DoE (2008: 9).

Role of the Teacher in Civil Technology Integrated curriculum

The study obtained that teacher are more hands-on, on implementing quality curriculum of civil technology as statement 8,9,10 and 11 revealed that teachers in majority work hard on self-development to understand what their teaching. Do the department provide sufficient time and quality formal training to the teachers? Results from both questionnaires and interviews reports that teachers received only five days’

workshop on civil technology curriculum and formal training was provided only for skill development. How South African education system expects quality education from the high schools though didn't provide formal training to the teachers? From the interviews perspective teachers both none experienced and experienced stated that: they only received formal training during their tertiary. If department of education invest only on skill development at high school level, it continues with the question that do we need only artisans in South Africa. This feather proves that the Department of Education just plan but do not monitor their implementation and results very well because instate of rectifying their just remove, according to government gazette of 18 July 2014 Minister of Basic Education approved and signed Curriculum and Assessment Policy Statement for the following new technology subjects: Civil Technology, Electrical Technology, Mechanical Technology, Technical Mathematics and Technical Science DoE (2014: 3). The research feather revealed that on statement 6 and 12 teachers use problem solving (technological process) as the main strategy or method to implement curriculum of civil technology, but only three teachers who disagreed that they use problem solving and it raised concerns why? According to Teis (2010) the aim of problem solving in technology is to stimulate a scientific method of hypothesis generation and testing. Therefore problem solving is the only method used to perform Practical Assessment Task (PAT). The Technological Process is the rationale and driving force behind this subject. Creativity, innovation and ingenuity play a major role in developing the learners' full potential in this field (LPG) (DoE 2008: 7-8).

Teacher's Attitudes Towards Integrated Curriculum

The research shown that teachers do regard Civil Technology as the subject designed only for intelligent peoples from statement 1 and 2 therefore that implies teachers have fear not negative attitudes towards integrated curriculum. Statement 14, 15, 16 and 17 brought a clear perspective that teachers are indeed interested to master the subject as in has developed positive attitude to mathematics and science and they need support of applied mechanics in Civil Tech-

nology. Therefore that confirm statement by Maimane (2006) when he said education is a social activity which calls for skilled teaching personnel to guide inexperienced individuals by applying whatever mediation tools (physical as well as symbolic objects) are available. He further cited Koen (2000: 16) describes mathematics as a fascinating game which learners can enjoy. He argues that mathematics teachers and learners need to act in ways that go beyond the physical classrooms and the cognitive aspects of the mathematics being dealt with (Maimane 2006: 244-245).

CONCLUSION

In conclusion, it was clear that, there was no curriculum formal training conducted by Department of Education for Civil Technology teachers in Free State province only workshops were conducted therefore that left teachers without full knowledge of curriculum and how to implement it.

RECOMMENDATIONS

Teachers recommended that the department of education must convey full course training in applied mechanics of civil technology and other disciplines in the curriculum. That shows the interest of the teachers in Civil Technology as it is, also from the interview recommendations were made for the new CAPS civil technology must remain as it is for the purpose of the learners who want to pursue academic stream of education and for those who are interested to be artisan stream they must follow technical stream.

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